

Afromontane species of *Wiedemannia* Zetterstedt from East Africa (Diptera: Empididae: Clinocerinae)

by

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ABSTRACT

The Afromontane species of *Wiedemannia* Zetterstedt from East Africa are reviewed. *Clinocera aquatica* (Becker) is reclassified as *Wiedemannia aquatica* (Becker) comb.n., and *W. kenyae* sp. n. from Mt Kenya is described. The species of the Ruwenzori Range and those of Mt Kenya form two distinct groups, with the former group considered most closely related to Southern African species. Additional biogeographic patterns and relationships with Southern African species are detailed.

INTRODUCTION

Some 300 species of Empidoidea, exclusive of Dolichopodidae (Diptera), have been recorded from the Afrotropical Region, but the vast majority are limited to Southern Africa (Smith 1980). Approximately 16 % of this total are from East Africa, primarily a reflection of the lack of monographic reviews from this region. There are 29 recorded Afrotropical species of Clinocerinae (Sinclair 1999), among which are only two previously recognized species of *Wiedemannia* Zetterstedt from East Africa (Garrett Jones 1940).

East Africa remains poorly collected; its empidid fauna is known primarily on the basis of several independent surveys which have resulted in a few sporadic papers describing single species. The known African species of *Wiedemannia* form a monophyletic group strongly supported by the unique attachment of the apical phallic filament or distiphallus and the long, sickle-shaped projection of the subepandrial sclerite (Sinclair 1999). Although not currently assigned to a subgenus, they appear most closely related to the European subgenera *Eucelidia* Mik and *Roederella* Engel, on the basis of long, erect seta(e) on the fore coxa and reduced number and size of acrostichal setae (Sinclair 1995). Based on the lack of distinctive acrostichal setae, this African species-group, along with the above two subgenera and the *lepida*-group (Sinclair 1998), represent the most plesiomorphic clades within *Wiedemannia* (Sinclair, unpubl. data). The inter-relationships of the subgenera of *Wiedemannia* are more fully discussed by Sinclair (1995).

Species of *Wiedemannia* are generally confined to large, cool streams and rivers, and the genus represents another example of the strikingly disjunct Afrotropical montane or Afromontane fauna (Fig. 1). The Afromontane region is defined as an archipelago of centres of endemism primarily above 2000 m in the tropics, but

reaching near sea-level in more temperate latitudes of Southern Africa (White 1983). These centres are scattered across Africa from the mountains of Sierra Leone to Somalia and from Sudan to the Western Cape Province of South Africa.

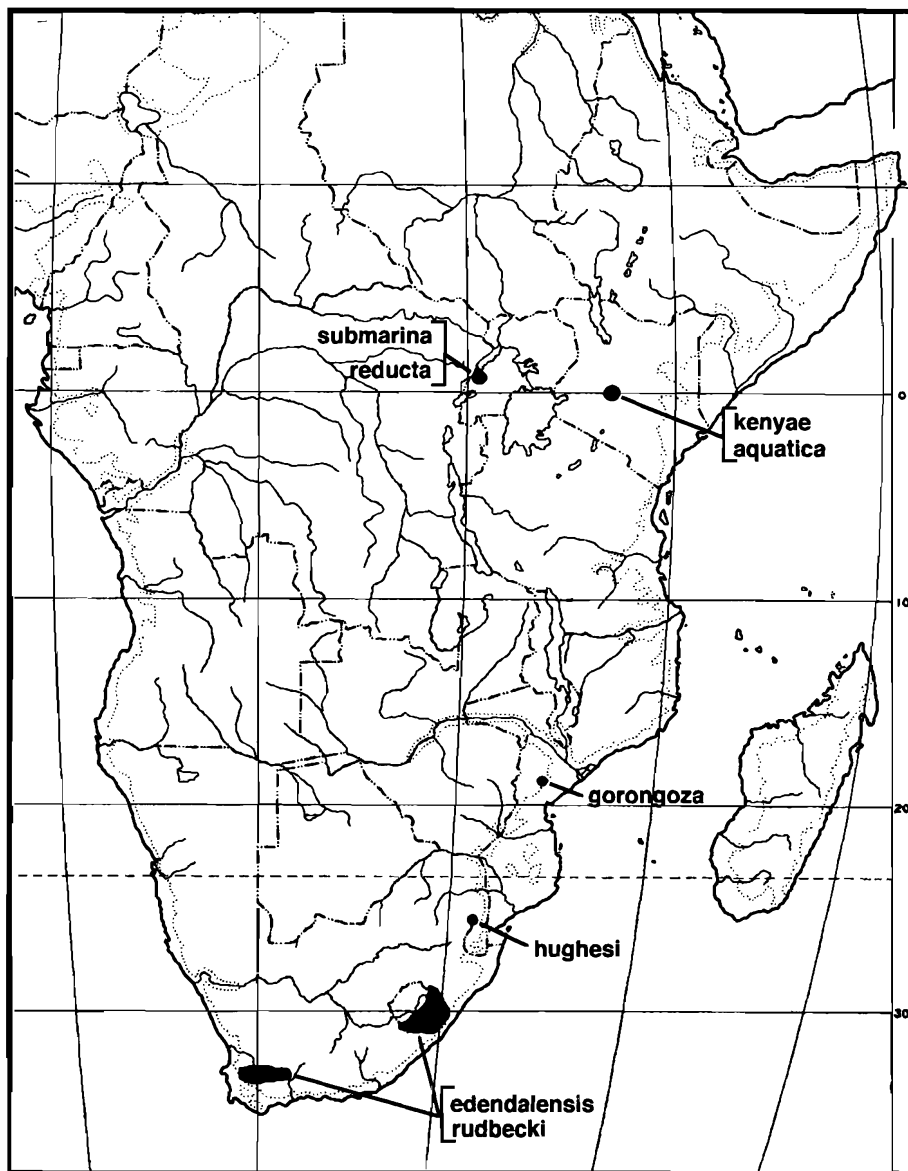


Fig. 1. Known distribution of Afromontane species of *Wiedemannia*.

The discovery of an undescribed species of *Wiedemannia* from Mount Kenya provided the opportunity to review the East African taxa and discuss their biogeographic and phylogenetic relationships with Southern African species.

MATERIALS AND METHODS

This study was based on the examination of adult specimens borrowed from the following institutions: The Natural History Museum, London, England (BMNH); Museum National d'Histoire Naturelle, Paris, France (MNHP).

Terms used for adult structures primarily follow those of McAlpine (1981), and for the male terminalia those of Sinclair (1994) and Cumming *et al.* (1995). To facilitate observation, terminalia were macerated in hot 85 % lactic acid and immersed in glycerine. Label data of holotypes are cited in full, with original spelling, punctuation and date; lines are delimited by a slash mark (/), and a semicolon separates data quoted from different labels. The following abbreviations are used in the descriptions: dc – dorsocentral bristles; npl – notopleural bristles; pprn – postpronotal bristles; presut spal – presutural supra-alar bristles; psut spal – postsutural supra-alar bristles; pal – postalar bristles; sctl – scutellar bristles.

TAXONOMY

Key to males of East African species of *Wiedemannia*

(Females are generally very difficult to identify without associated males)

- 1 Wings greatly reduced and strap-like.....**reducta** Garrett Jones
- Wings normally developed.....2
- 2 Claspig cercus broad, mitten-like in lateral view (Fig. 5).....**submarina** Garrett Jones
- Claspig cercus more slender in lateral view (Figs 2–4)3
- 3 Claspig cercus divided apically into three lobes (Fig. 3).....**aquatica** (Becker)
- Claspig cercus with apical two-thirds slender, abruptly expanded at base (Fig. 4)**kenyae** sp. n.

Wiedemannia aquatica (Becker), **comb. n.**

Figs 2, 3

Atalanta aquatica Becker, 1914: 122; 1915: 154.

Clinocera aquatica: Smith, 1967: 230; 1980: 440 (subgenerically unplaced species of *Clinocera*); Sinclair, 1995: 694 (unplaced in species-group).

Holotype ♂: KENYA: '45 2-II-12 [Stn. 45; 2.ii.1912]'; 'Mont Kénya/ zone des prairies/ supérieures/ 4000m.'; 'TYPE [red label]'; '*Atalanta aquatica* Beck. [handwritten]' (MNHP).

Recognition: Distinguished from other East African species by the trilobed claspig cercus and stout setulae interspersed between the dorsocentral bristles.

Description:

Male: Wing length 4.3 mm.

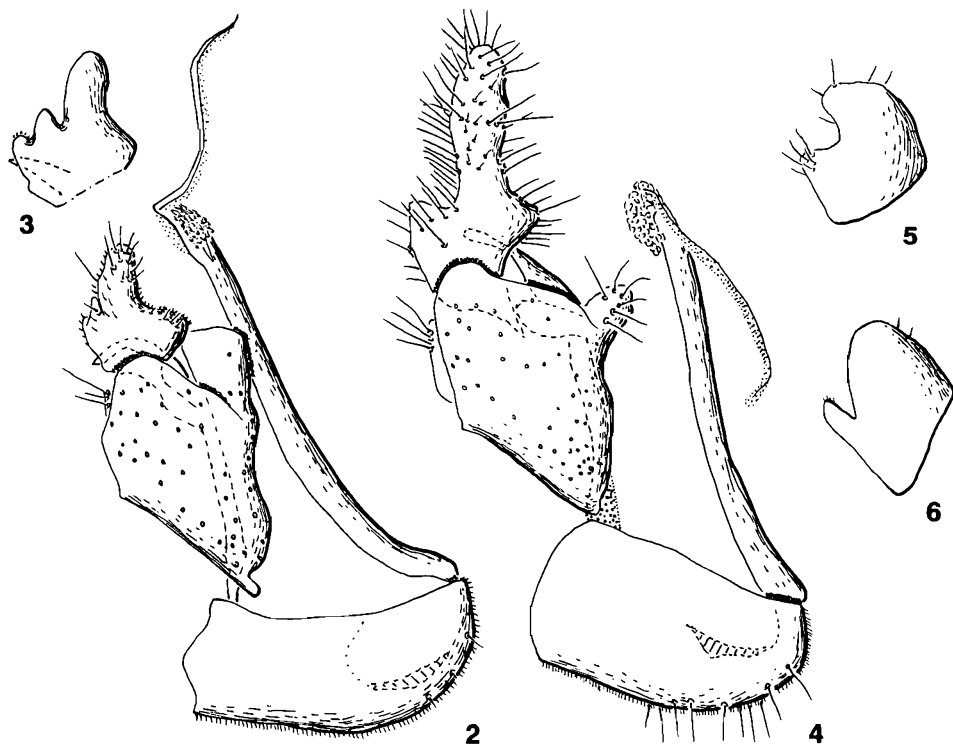
Head: Upper half of face above carina and gena with pale blue pruinescence; carina dark with pair of lateral, bright blue pruinescent, oval patches; vertex brown; ocellar seta short and slender. Genal width one-fourth height of eye. Arista short, tip blunt;

first flagellomere and arista somewhat reddish-brown, basal antennal segments dark brown. Setae on palpus pale brown.

Thorax: Pleura and laterotergite with blue pruinescence; scutum, mediotergite brown; scutum lacking vittae. Several acrostichals anterior to first dc; 5 pairs dc, rather weak except fifth, with 4–6 short, fairly stout setulae interspersed; 1 ppm; 0 presut spal; 2 npl; 1 psut spal; 1 pal; 1 pair sctl, inner and outer marginal setae, with more than 10 short setulae on disc; scattered setulae on notopleuron and presutural supra-alar regions. Laterotergite with patch of dark setae; proepisternum above fore coxa with 5–6 dark setae.

Wing: Broad, darkly infusate; stigma faint, elongate, overlapping apex of R_1 ; single costal bristle; R_4 and R_5 straight and divergent; apex of cell dm prolonged; M_1 and M_2 widely separated. Halter dark.

Legs: Coxae with blue pruinescence, concolorous with pleura; remaining leg segments dark brown. Fore coxa with 1 strong, erect seta near middle; remaining segments lacking distinct macrosetae. Fifth tarsomere with long, dorsoapical extension; empodium pulvilliform, yellowish-white, laterally flattened, extending beyond extension of tarsomere.



Figs 2–6. Male terminalia of *Wiedemannia*, lateral view. 2. *W. aquatica* (Becker) 3. *W. aquatica*, clasper, anterior view. 4. *W. kenyae* sp. n. 5. *W. submarina* Garrett Jones, clasper. 6. *W. reducta* Garrett Jones, clasper.

Abdomen: Sternites and lateral margin of tergites with blue pruinescence; dorsum and terminalia dull brown. Tergite 8 slender, rectangular.

Terminalia: Hypandrium stout, subrectangular, longer than epandrium. Phallus strongly arched at base, apical two-thirds straight; apex of shaft with pair of small, membranous sacs; distiphallus arising from narrow apex, sinuous, lacking median swelling; ejaculatory apodeme long, narrow, recurved. Epandrium subrectangular, not swollen laterally, little wider than hypandrium; long setae along dorsal margin. Subepandrial sclerite with pointed, triangular, apical prolongation, extending beyond base of claspings cercus. Surstylus short, truncate, ventro-apical corner somewhat narrowed. Cercal plate with macrosetae confined to dorsal tubercle. Claspings cercus with 3 lobes (anterior view); inner lobe shortest, bearing stout setae on inner, apical face; median lobe twice length of inner lobe; outer lobe wider, longer than other lobes, bearing long marginal setae; claspings cercus subtriangular in lateral view.

Female: Unknown.

Remarks: This species is transferred from *Clinocera* Meigen to *Wiedemannia* because of its facial carina, recurved distiphallus and enlarged claspings cercus, all of which are diagnostic for the genus. It appears to be very similar to the following new species, also from Mt Kenya. With this reassignment, there are no afrotropical species of *Clinocera* outside of South Africa.

***Wiedemannia kenyae* sp. n.**

Figs 4, 5

Holotype ♂: KENYA: 'KENYA: Mt. Kenya,/ N. side,/ Liki Stream, 13000'/ 20.–22.xii.1980,/ P.S. Cranston,/ B.M. 1981–79'; 'HOLOTYPE/ *Wiedemannia/ kenyae* Sinclair' [red label] (BMNH).

Recognition: Males are distinguished from all other African species of *Wiedemannia* by their long, narrow claspings cercus.

Description: Wing length 6.3–6.5 mm.

Male:

Head: Face and gena with pale blue pruinescence in lateral view; face brown with pair of bright, lateral, blue pruinose, oval patches beside dark carina in frontal view; vertex brown; ocellar seta short and slender. Genal width nearly one-fourth height of eye. Arista short, tip blunt; entire antenna dark brown. Setae on palpus brown.

Thorax: Pleura, laterotergite, and mediotergite with blue pruinescence; scutum brown, lacking distinct vittae, although region between dorsocentrals is pale. Several acrostichals anterior to first dc; 5 pairs dc, increasing in length posteriorly, with 2–6 short setulae interspersed; 1 ppn, with scattered setulae; 0 presut spal; 2 npl; 1 psut spal; 1 pal; 1 pair sctl, with inner and outer marginal setae, and about 10 short setulae on disc; scattered setulae on notopleuron and presutural supra-alar regions. Laterotergite with patch of dark setae; proepisternum above fore coxa with 4–6 dark setae. Antepnotum with 1 pair of long, stout setae and several short, stout setae.

Wing: Broad, darkly infuscate; stigma apparently not visible; single costal bristle;

R₄ and R₅ straight and divergent; apex of cell dm prolonged; M₁ and M₂ narrowly to widely separated. Halter dark.

Legs: Coxae with blue pruinescence, concolorous with pleura; remaining leg segments dark brown. Fore coxa with 1 strong, erect seta near middle; remaining segments lacking distinct macrosetae. Fifth tarsomere with long, dorsoapical extension; empodium pulvilliform, yellowish-brown, laterally flattened, extending beyond extension of tarsomere.

Abdomen: Sternites and lateral margin of tergites with blue pruinescence; dorsum and terminalia dull brown. Tergite 8 slender, rectangular.

Terminalia: Hypandrium stout, subrectangular, longer than epandrium. Phallus slightly arched at base, apical two-thirds straight; apex of shaft with pair of small, membranous sacs; distiphallus arising from narrow apex, somewhat curved, lacking median swelling; ejaculatory apodeme long, narrow, recurved. Epandrium subrectangular, not swollen laterally, little wider than hypandrium; long setae along dorsal margin. Subepandrial sclerite with pointed, triangular, apical prolongation, extending beyond base of clasping cercus. Surstylus short, truncate. Cercal plate with macrosetae confined to dorsal third. Clasping cercus with apical two-thirds slender, base abruptly widened; lateral margin with long setae; anterior basal lobe with short, dense setae on inner face; inner face of apex with long, slender setae; lacking stout inner setae.

Female: Similar to male. Terminalia (undissected) with segment 8 short; cercus slender, nearly as long as segment 8.

Additional material: Paratypes: KENYA: 1 ♂ 1 ♀, same data as holotype (BMNH). An additional female not included in the type series is stored in the alcohol collection.

Remarks: Specimens were collected from the surface scum of a small, cold stream at 4000 m, flowing over gravel. The stream freezes at night, but is not fed by glacier-melt water. See Willassen & Cranston (1986) for more details of the type locality.

Wiedemannia reducta Garrett Jones

Fig. 6

Wiedemannia reducta Garrett Jones, 1940: 303

Recognition: Both sexes are easily distinguished from all other species by the reduced, strap-like wings.

Description: See Garrett Jones (1940).

Remarks: This species was collected at 4300–4500 m (alpine zone) in the Ruwenzori Range. It is most closely related to *W. submarina*, which was collected at 3100 m (forest zone). The clasping cercus of both species differs only slightly (Figs 5, 6), but *W. reducta* is readily distinguished by its greatly reduced, stenopterous wings (Garrett Jones 1940, fig. 11c). This is the only known species of this genus with reduced wings, a modification uncommon in clinocerines. Other examples of reduced wing forms in the subfamily are known in *Dolichocephala* Macquart, including two species collected at the same locality as *W. reducta* (Garrett Jones 1940), and an undescribed species from the western Nearctic (Sinclair 1995).

The high altitudes of East African mountains are renowned for the great number of Diptera with reduced wings (Hackman 1964; Mani 1968). In fact, a number of brachypterous species of various families are known from the same alpine habitats, including species of Tipulidae, Sphaeroceridae, Sepsidae and Chloropidae (Hackman 1964). Most of these species, including *Dolichocephala*, are terricolous, found in leaf litter and low dense vegetation. Since both fully-winged and brachypterous species occur together in these habitats, it is doubtful that a direct correlation exists between wing reduction and high altitude alone. However, *W. reducta* is restricted to mountain streams which are often exposed to strong winds, and it is possible that this environmental factor has selected for wing reduction in this species.

The apparently sympatric species in East Africa are possibly restricted to different altitudes as currently known for the Ruwenzori species (see above). On Mt Kenya, further on-site collections are required to determine precisely if elevation or different micro-habitat factors exist. Elevation, water temperature, flow rate, and food resources have been documented as factors limiting the distribution of *Wiedemannia* along water courses in France (Vaillant 1967).

EVOLUTIONARY HISTORY

Unfortunately, not many distinct external morphological features are known that confidently allow recognition of species-groups. Consequently, the relationships described below are based on perceived derived similarities of the male clasping cercus. Using these criteria, the African species of *Wiedemannia* can be tentatively divided into four distinct and widely disjunct groups (Fig. 1). *Wiedemannia* (*Eucelidia*) *zetterstedti* (Fallén) was selected as the outgroup taxon.

Group 1 (*W. reducta* and *W. submarina* from the Ruwenzori)

This group is characterised by the mitten-shaped clasping cercus, with its broad oval shape. Both Groups 1 and 2 occur in the East African Volcanoes area of endemism (*sensu* Griswold 1991). However, based on the form of the male terminalia they do not appear related, with Group 1 possibly most closely related to Group 3 from Southern Africa.

Group 2 (*W. aquatica* and *W. kenyae* from Mt Kenya)

These two species are considered closely related based on the highly sculptured clasping cercus. This group appears to be only distantly related to the other East African species (see Group 1 above).

Group 3 (*W. edendalensis* Smith, 1969, *W. gorongoza* Smith, 1969 and *W. rudbecki* Smith, 1967, from Southern Africa)

This group is characterised by the form of the clasping cercus, in which the lobes are divergent and distinctly separated (Smith 1969, figs 378, 380; Sinclair 1999, figs 18, 21). Two species of this group are widespread in South Africa, dispersed over several regions of endemism, known from both the Cape and Eastern Highlands Centres (*sensu* Stuckenberg 1962). Although *W. gorongoza* has probably been isolated from other congeneric Southern Africa species by the dry Limpopo valley since at least the mid-

Tertiary (Stuckenberg 1962), it shows only slight morphological differences and may possibly be conspecific with *W. edendalensis* (see Sinclair 1999).

Group 4 (*W. hughesi* Smith, 1969)

This species possesses extremely modified and autapomorphic male and female terminalia (Sinclair 1999, figs 19, 20), which are currently not informative for species relationships. It is geographically isolated in the Transvaal Drakensberg area of endemism, and its unique genitalic modifications possibly indicate a long period of isolation.

The current distribution of *Wiedemannia* in East Africa is restricted to cold water environments at high elevations. This restriction is likely due to topography ensuring permanent running water over a geologically suitable substrate (stony or rocky habitats), required by immature stages and adults alike. This observation can be confirmed by the presence of *Wiedemannia* in South Africa in streams flowing through open grassland in mountainous terrain at various elevations.

Given the dependence on permanent flowing water, a widespread ancestral distribution of African *Wiedemannia* likely predates the increased aridity and seasonal changes in rainfall of the mid-Tertiary. Strong seasonality of rainfall affecting year-round water flow, would have reduced clinocerine habitat and led to the isolation observed today. Species restricted to and not shared between neighbouring ranges in East Africa, especially the brachypterous species *W. reducta*, suggests that dry corridors existed during the glacial episodes of the Pleistocene and presented a barrier to dispersal (Brühl 1997). Thus the modern species of *Wiedemannia* possibly evolved *in situ*, confined to montane habitats of East Africa since the pre-Pleistocene.

Collecting of clinocerines in the Afrotropics has been haphazard and biased towards the prominent mountains. Their occurrences on isolated mountains suggests that clinocerines should be searched for in intervening areas. It is also possible that clinocerines could occur in poorly collected prominent montane areas such as Ethiopia and Yemen, where mountain streams still exist, despite the aridity of the surrounding country.

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